Bulletin V-30

Mark Series Position Indicator/Transmitter Installation and Operating Manual

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Printed in U.S.A. 10/09 FR# 85-443266-00 Rev. 5

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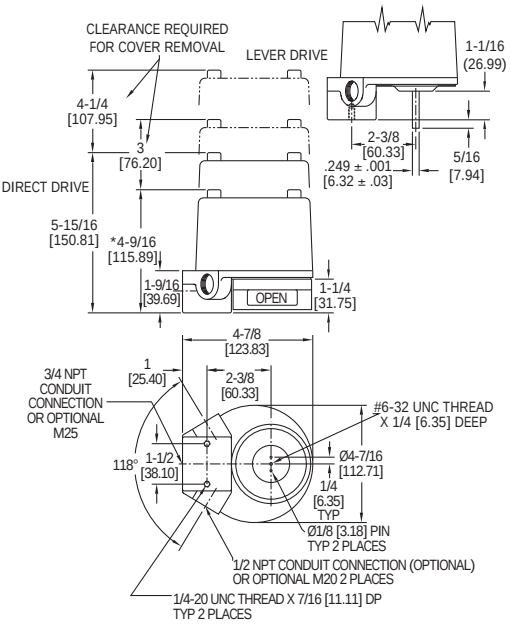
DIMENSIONS



*FOR MODELS 11, 12, 41 & 42

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INTRODUCTION

The Proximity Mark Series is a line of position indicators with a selection of various output options. Three model styles make up the Mark Series to cover almost any application. A patented magnetic drive that completely seals the switch compartment from the atmosphere for maximum leak protection is utilized in the Mark 1. The Mark 3 uses the same magnetic drive of the Mark 1, but it can be used for multi-turn applications with 1 to 25 revolutions, such as gate valves. A through shaft drive is incorporated in the Mark 4 making the unit a lower cost alternative to the Mark 1 for applications that are not as demanding.

Standard models in the Mark Series have visual position indicators and are weatherproof, flameproof, and submersible. A large variety of outputs are available to fit specific applications. There is a choice of 1 to 6 switch outputs of 13 varieties including inductive sensors, high temperature switches, gold contact switches, hermetically sealed switches, and high current switches. Besides the switch outputs the Series offers potentiometer outputs, 4 to 20 mA transmitters and HART® communication.

The units are purchased for either direct drive applications, such as rotary valves, or lever drive applications, such as linear valves. For the Mark 1, 3, and 4 this instruction manual starts with installation of the unit to the device being monitored, and the set up of switch models. Separate instructions follow covering the potentiometer and transmitter set up if your unit has those options.

SPECIFICATIONS

General

Product Ratings:

Weatherproof and flameproof. NEMA 1, 2, 3, 3R, 3S, 4, 4X, 6, 7, 9, 12, 13. (Housing styles M and N are NEMA 4, 4X only.)

UL rated: Class I, Div. 1 & 2, Groups B, C, D (Some units available for Group A, consult factory); Class II, Div. 1 & 2, Groups E, F, and G.

CSA rated: Class I, Div. 1 & 2, Groups A, B, C, D; Class II, Div. 1 & 2, Groups E, F, and G; Submersible to 50 feet.

SAA rated: -S suffix, Certified Ex d IIC T6 IP68 (15 meters).

ATEX Compliant:
-B suffix, directive 94/9/EC,
KEMA 03 ATEX 2391X, CE 0344 Ⓔx II 2 G Ex d IIC T6 for -25°C/-40°C/-50°C ≤ Tamb ≤ 70°C and T5 for -25°C/-40°C/-50°C ≤ Tamb ≤ 80°C optional wording depending on output and switch type selected. Compliant per EN 60079-0:2006 and EN 60079-1:2004.
–IS suffix directive 94/9/EC,
KEMA 03 ATEX 1392X, CE 0344 Ⓔx II 1 G Ex ia IIC T4.
(Switch type C is not available with ATEX; Switch type B is not available with ATEX intrinsically safe, -IS suffix). Compliant per EN 60079-0: 2006, EN 60079-11: 2007, and EN 60079-26: 2007.

Electrical Connections: Screw terminal. Optional factory sealed leads that are 36″ (914.4 mm) of 16 AWG.
Conduit Connection: 3/4″ female NPT standard. Optional one or two 1/2″ female NPT. M25 and M20 optional (Standard on SAA certified products).
Mounting Orientation: Not position sensitive.
Weight: 4 to 6 lb (1.5 to 3.0 kg).
Operational Life: Over 10,000,000 cycles.
Maximum Altitude: 2000 meters.
Patents: US 5357067.

Mark 1, 3 and 4 with Switch Outputs

Temperature Limits: -58 to 176°F (-50 to 80°C). Switch Type C rated to 350°F (176°C) for 600 hours, Switch Type T rated to 250°F (121°C) continuous. (ATEX flameproof, -B suffix, rated -50°C (-58°F) to 80°C (176°F) for switch type A, G, H, T, or M, -40°C (-40°F) to 80°C (176°F) for switch type O, R, S, V, or W, -25°C (-13°F) to 80°C (176°F) for switch type B, D, I, or AS Interface; ATEX intrinsically safe, -IS suffix rated -25°C (-13°F) to 40°C (104°F) for switch type D or I, -40°C (-40°F) to 40°C (104°F) for switch type R, V, or W, or -50°C (-58°F) to 40°C (104°F) for switch type A, G, or H.)
Switch Type: See model chart on pages 5 and 6.
Electrical Rating: See model chart on pages 5 and 6.
Set Point Adjustment: Mark 1 and 4: 5 to 360°. Mark 3: 1 to 25 revolutions.

Mark 1, 3, and 4 with Potentiometer
Accuracy: ± 0.5% of full span. Optional ± 0.25% of full span.
Temperature Limits: -40 to 176°F (-40 to 80°C).(ATEX flameproof, -B suffix, rated -40°C (-40°F) to 80°C (176°F) for switch types A, G, M, O, R, S, T, V, or W, -25°C (-13°F) to 80°C (176°F) for switch types B, D, or I.; ATEX intrinsically safe, -IS suffix, rated -25°C (-13°F) to 40°C (104°F) for switch type I, -40°C (-40°F) to 40°C (104°F) for switch types O, R, S, V, or W.)
Power Rating: 1.5 Watt maximum.
Output Signal: 1000 Ohm standard. Optional 2000, 5000, 10000, or 20000 Ohms.
Zero and Span Adjustments: Span trim pot with 2000 Ohm adjustment. No zero adjustment.
Rotational Travel: Mark 1 and 4: Minimum: 0°, Maximum: 340°. Mark 3: 0 to 10 revolutions.

Mark 1, 3, and 4 with Transmitter
Accuracy: ± 0.5% of full span. Optional ± 0.25% of full span.
Temperature Limits: -40 to 176°F (-40 to 80°C). (ATEX flameproof, -B suffix, rated -40°C (-40°F) to 80°C (176°F) for switch types A, G, M, O, R, S, T, V, or W, -25°C (-13°F) to 80°C (176°F) for switch types B, D, or I.; ATEX intrinsically safe, -IS suffix, rated -25°C (-13°F) to 40°C (104°F) for switch type I, -40°C (-40°F) to 40°C (104°F) for switch types O, R, S, V, or W.)
Power Requirements: 5 to 30 VDC.
Current Consumption: 50 mA.
Output Signal: 4 to 20 mA.
Zero and Span Adjustments: Trim pots for adjusting both. Mark 1 and 4: Span is adjustable from 50 to 300°. Mark 3: Span is adjustable from 1.5 to 8.5 revolutions.
Conduit Connection: 3/4˝ female NPT standard. Optional one or two 1/2˝ female NPT. M25 and M20 optional (Standard on SAA models).
Rotational Travel: Mark 1 and 4: Minimum: 50°, Maximum: 300°. Mark 3: Minimum: 1.5 revolutions, Maximum: 8.5 revolutions.

Mark 1, 3, and 4 Transmitter with HART® communication
Accuracy: ± 0.5% of full span. Optional ± 0.25% of full span.
Temperature Limits: -40 to 176°F (-40 to 80°C). [ATEX flameproof, -B suffix, rated -40°C (-4°F) to 80°C (176°F) for switch types A, G, M, O, R, S, V or W, -25°C (-13°F) to 80°C (176°F) for switch types B, D or I; ATEX intrinsically safe, -IS suffix, rated -40°C (-40°F) to 40°C (104°F) for switch types O, R, S, V or W; -25°C (-13°F) to 40°C (104°F) for switch type I].
Power Requirements: 8 to 30 VDC.
Current Consumption: 21 mA.
Output Signal: 4 to 20 mA.
HART® Receive Impedance: Rx = 500 kΩ; Cx = 2500 pF.
Zero and Span Adjustments: Pushbuttons or HART® communication master for setting both. Mark 1 and 4: Span is adjustable from 0 to 330°. Mark 3: Span is adjustable from 1.5 to 8.5 revolutions.
Conduit Connection: 3/4˝ female NPT standard. Optional one or two 1/2˝ female NPT. M25 and M20 optional (Standard on SAA models).
Rotational Travel: Mark 1 and 4: Maximum: 330°. Mark 3: Minimum: 1.5 revolutions, Maximum: 8.5 revolutions.

MODEL CHART

					Available Options "A" signifies available with corresponding construction style.		
Con-struction	1 3 4			Mark 1, Magnetic Coupling Mark 3, Multi-Turn Mark 4, Thru-Shaft	Mark		
					1	3	4
Output Type		1		1 Switch	A	--	A
		2		2 Switches	A	A	A
		3		Potentiometer, 1K Ohm. Available with switches, see note below.*	A	A	A
		32		Potentiometer, 2K Ohm. Available with switches, see note below.*	A	A	A
		35		Potentiometer, 5K Ohm. Available with switches, see note below.*	A	A	A
		310		Potentiometer, 10K Ohm. Available with switches, see note below.*	A	A	A
		320		Potentiometer, 20K Ohm. Available with switches, see note below.*	A	A	A
		4		4 Switches	A	A	A
		5		Transmitter, 4 to 20mA. Available with switches, see note below.*	A	A	A
		6		6 Switches. Available with Switch Types B, C, I, R, V, W.	A	A	A
		7		AS-interface and 1 Switch. Available with Switch Types B, I, R, W.	A	--	A
		8		AS-interface and 2 Switches. Available with Switch Types B, I, R, W.	A	--	A
		9		Transmitter with HART® communication. Available with switches, see note below.*	A	A	A
Switch Type & Rating			A	SPDT Snap, Rated: 15A @ 125/250/480 VAC (~) 1/8 hp @ 125 VAC (~) 1/4 hp @ 250 VAC (~) 1/2A @ 125 VDC (⎓), 1/4A @ 250 VDC (⎓)	A	A	A
			B	Inductive Sensor. 10 to 30 VDC (⎓) Load: 0.1A.	A	--	A
			C	SPDT High Temperature Snap, 350°F (176°C) for 600 hours, Rated: 15.1A @ 125/250/277 VAC (~)	A	A	A
			D	DPDT Snap, Rated: 10A @ 125/250 VAC (~) 0.3A @ 125 VDC (⎓) 0.15A @ 250 VDC (⎓)	A	A	A
			G	SPDT Gold Contact Snap, Rated: 1A @ 125 VAC (~)	A	A	A
			H	SPDT Hermetically Sealed Snap, Rated: 1A @ 125 VAC (~)	A	--	A
			I	NAMUR Inductive Sensor. 15 mA max @ 5-25 VDC (⎓)	A	--	A
			M	SPDT Magnetic Blow-Out, Rated: 10A @ 125 VAC (~)/VDC (⎓) 1/4 hp @ 125 VAC (~)/VDC (⎓)	A	A	A
			0	No Switches	A	A	A
			R	SPDT Hermetically Sealed Reed, Rated: 2A @ 125 VAC (~) 2A @ 24 VDC (⎓)	A	--	A
			S	SPDT Snap, Rated: 4A @ 125/250 VAC (~).	A	--	A
			T	SPDT High Temperature Snap, 250°F (121°C) Continuous, Rated: 5A @ 125/250/480 VAC (~).	A	A	A
			V	SPDT Snap, Rated: 10A @ 125/250 VAC (~) 1/3 hp @ 125/250 VAC (~) 1/2A @ 125 VDC (⎓) 1/4A @ 250 VDC (⎓) 4A @ 125 VAC (~)(tungsten).	A	A	A
			W	SPDT Gold Contact Snap, Rated 0.1A @ 125 VAC (~).	A	A	A

*Note: Mark 1 and 4 potentiometer and transmitter outputs will have no switches when ordered with switch type 0; 2 switches if ordered with switch types B, C, I, R, V, or W; and 4 switches if ordered with switch type S. Mark 3 potentiometer and transmitter outputs will have no switches when ordered with switch type 0, and 2 switches if ordered with switch types A, D, G, M or T.

					Available Options "A" signifies available with corresponding construction style.		
					Mark		
					1	3	4
Driving Method	D			Direct Drive (Yoke) with Stainless Steel Visual Indicator.	A	A	A
	L			Lever Drive (Shaft), No Visual Indicator.	A	A	A
Enclosure		0		Aluminum, Painted Black	A	A	A
		1		Aluminum, Painted White Epoxy with SS trim	A	A	A
		2		Aluminum, Painted Red	A	A	A
		5		Aluminum, Painted (color not yet specified)	A	A	A
		6		Cast 316 Stainless Steel	A	A	A
		7 thru 20		Aluminum, Painted (color not yet specified)	A	A	A
					A	A	A
					A	A	A
Options			J1	Junction Package with One 1/2″ NPT Female Conduit Connection and Terminal Strip.	A	A	A
			J2	Junction Package with Two 1/2″ NPT Female Conduit Connection and Terminal Strip.	A	A	A
			S	SAA Listed Flameproof	A	A	A
			SV1	1 Attached Solenoid Valve (Must be ordered with J1 option).	A	--	A
			SV2	2 Attached Solenoid Valves (Must be ordered with J2 option).	A	--	A
			MT	Metric Threaded Conduit Connection, M25 (M20 for optional J1 and J2 connections).	A	A	A
			B	Directive 94/9/EC, KEMA 03 ATEX 2391 x, CE 0344 Ex II 2 G Ex d IIC T6 (-25/-40/-50°C ≤ Tamb ≤ 70°C) (T5 (-25/-40/-50°C ≤ Tamb ≤ 80°C) optional wording). Depending Output and Switch Type Selected.	A	A	A
			IS	Directive 94/9/EC, KEMA 03 ATEX 1392 x, CE 0344 Ex II 1 G Ex ia IIC T4.	A	A	A

EXAMPLE MODEL NUMBERS

12VD0-J1

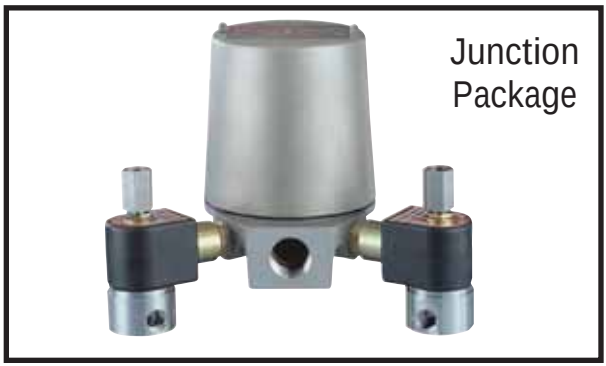
Mark 1, 2 Switches both Type V – SPDT, Direct Drive, Painted Aluminum Enclosure with Junction Package.

15VD0

Mark 1, 2 Switches both Type V – SPDT, 4 to 20 mA transmitter, Direct Drive, Painted Aluminum Enclosure.

JUNCTION PACKAGE

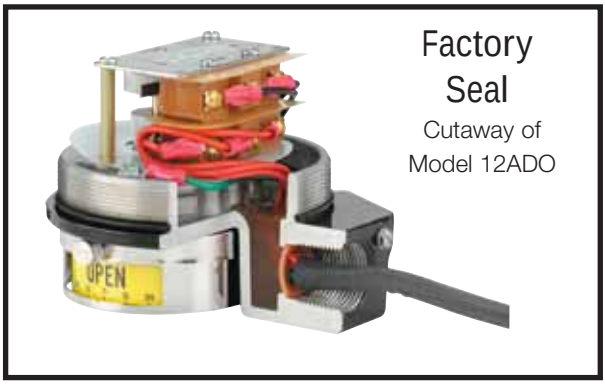
Complete factory assembled packages combine visual indication, solenoids, switches and transmitter in a single convenient UL, CSA, SAA certified or ATEX compliant assembly which saves labor and reduces cost. The simple package is shipped ready for installation, complete with optional custom designed mounting kit for your specific application. Many options are available such as painted aluminum, epoxy coated aluminum or stainless steel housings including a standard 3/4" NPT conduit entrance and choice of 1 or 2 additional 1/2" NPT conduit entrances. The optional conduit entrances are drilled and tapped in the base of the position indicator housing and solenoid valves are screwed into the entrances. 22 to 16 AWG wire leads from solenoids, switches and optional transmitter are terminated in prelabeled, easy-access terminal strips protected inside the housing. Note: UL, CSA and SAA approval and ATEX compliance requires complete package assembly by Proximity. Consult the factory for recommended UL, CSA, SAA approved or ATEX compliant solenoid valve options. Please consult page 3 and 4 for ATEX Safety Code.



Note: Junction package is not available on six switch models, switch type A, D, G, H, and T models.

FACTORY SEALED LEADS

Eliminate the possibility of conduit contamination and the need for seal fittings with Proximity's factory sealed (potted) leads. This seal has been UL tested to 6000 psi (413 bar) and is UL and CSA listed for Class I, Groups A, B, C, D; Class II, Groups E, F & G; Div. 1 & 2 locations. Groups may vary depending on the switch model. Standard leads are 16 AWG and 36˝ (91.44cm) long.

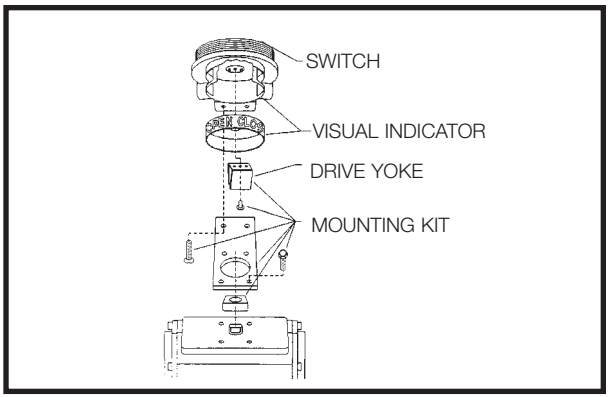


MOUNTING KITS

Mounting kits are available for direct installation of the Proximity Mark Series onto most valve and actuator brands. Proximity Controls has over 2000 kits available and can custom make kits for any application. Each kit is specially designed for a particular actuator or valve, making field mounting simple with standard tools. Mounting kits can be used with any model in the Mark Series, since external features are identical. Rotary valve kits utilize direct drive couplings, while linear valve kits use a lever drive.

Kits include a drive yoke or slotted lever arm, bracket, and fasteners made in either zinc plated steel or stainless steel. The high strength, spring tempered, stainless steel drive yoke/coupling is tailored to fit securely to a specific valve or actuator stem ensuring that there is no slippage or binding. No special alignment fixtures are required due to switch-offset design and yoke to stem engagement that makes installation a snap.

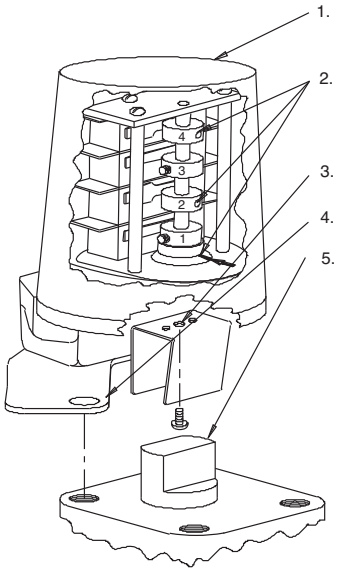
If you have purchased this unit without a mounting kit, please contact us to get the proper kit for your application.



VISUAL INDICATOR

A stainless steel mechanical visual indicator is standard on direct drive units. The indicator provides visual open and closed indication and a degree scale, which can easily be seen from 75 feet away. The scale is adjustable in 15° increments and the windows are adjustable in a 56° range with 90° fixed increments. Factory options include 180° indication, flow path indication, special colors, and LED's.

MARK 1 AND 4 DIRECT DRIVE INSTALLATION



INSTALLATION PROCEDURE

1. Unscrew cover. Keep threads clean and free from damage.
2. Switches are set at factory when in counterclockwise position. Index marks should appear as shown (Mark 1 only). Set screws, or holes in manual cams, (#2, 4 and 6) on Closed switches will be directly above index marks.

2 Switch Unit	#1 Open	#2 Closed
4 Switch Unit	#1, 3 Open	#2, 4 Closed
6 Switch Unit	#1,3,5 Open	#2,4,6 Closed

3. Attach appropriate Drive Yoke onto two pins using a #6-32 screw provided. (Note: Coupling is a special spring temper yoke or solid metal block. Do not attempt to fabricate your own yokes.)
4. Attach mounting bracket (127-003 is shown) to switch housing using 1/4˝ screws provided.
5. With actuator shaft rotated to its counterclockwise position, spread the Drive Yoke and slip it down onto the square (or rectangular) part of the actuator shaft. Attach bracket with two hex cap screws. Before tightening screws, operate control slowly with a wrench or power, and observe that drive shaft and drive yoke are concentric and perpendicular in complete stroke. Adjust position as required, and tighten all the mounting screws. Check concentricity and perpendicularity. Readjust per above steps as necessary.

ADJUSTMENT PROCEDURE

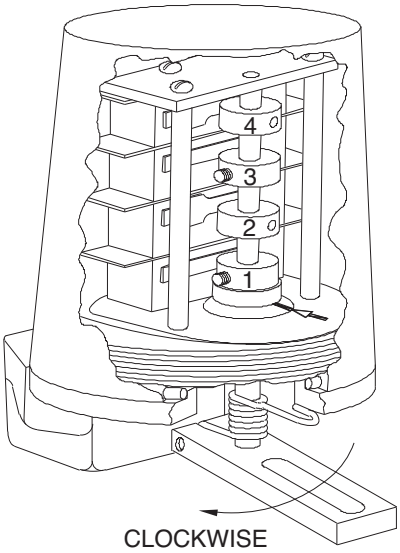
A. Using a wrench or power, rotate the actuator shaft to extreme clockwise position. All switches should change to their opposite function.

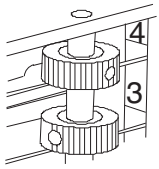
B. The cam can be relocated and repositioned by loosening the set screw. To adjust manual cams, grasp cam on knurled segment of cam surface. Simply rotate the cam on spline attached to the shaft. Feeling or sound of clicks indicates 6º incremental adjustments. Stop rotating and release pressure on cam when it is at proper actuation point. This allows cam to engage spline. Check the circuit to verify contact at proper point. Rotate shaft. Repeat steps above as necessary. Lock manual cam on spline by tightening set screw provided for additional security.

C. Screw on cover and tighten against o-ring seal until cover does not turn.

See Pages 19-23 for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

MARK 1 AND 4 LEVER DRIVE INSTALLATION





INSTALLATION PROCEDURE

1. Attach proper mounting bracket to switch housing using screws provided. Tubular spacers are provided for some installations.
2. Attach appropriate driving lever onto shaft. Do not tighten.
3. Attach switch and bracket to actuator, making sure that lever is free to rotate over entire range of actuator stroke.
4. Attach driving pin or bolt through lever arm if slotted, or on driving side of solid lever. (It may be necessary to loosen or remove mounting bracket to accomplish connection on some actuators.)
5. Operate actuator very slowly and observe movement of all pins and levers to be sure there are no interferences. Slide lever up or down on switch shaft to most desirable position. When all motions are made and clearances are adequate, tighten clamp screw on lever that was left loose in step 2. Tighten all mounting screws. Recheck the travel of all levers and pins for proper clearance through the entire stroke of the actuator.
6. Unscrew cover. Keep threads clean and free from damage. Index marks are imprinted into driven magnet collar as shown (Mark 1 only). Set screws or holes in manual cams (#2, 4 and 6) will be directly above index marks on those switches that are Closed. Marks must be in line when making switch cam adjustments. Cams are set at factory when in the counterclockwise position, as shown, and listed as follows:

2 Switch Unit	#1 Open	#2 Closed
4 Switch Unit	#1, 3 Open	#2, 4 Closed
6 Switch Unit	#1, 3, 5 Open	#2, 4, 6 Closed

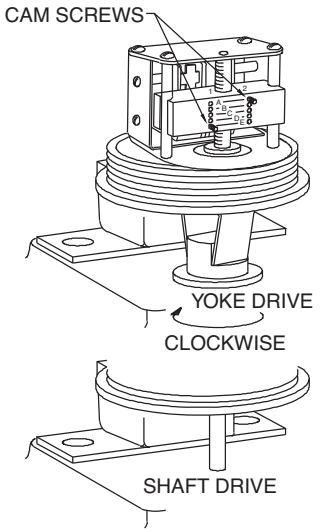
90º travel in clockwise direction will reverse all of above switch positions.

ADJUSTMENT PROCEDURE

A. Operate actuator to full closed position. Set screws hold cams in place on the shaft. For manual cams, grasp cam on knurled segment of cam surface and simply rotate cam to get correct actuation point. Clicks indicate incremental adjustments. Applying pressure on cam in direction of protruding actuation segment of cam surface, and rotating, eliminates incremental adjustments. Stop rotating and release pressure on cam when at proper actuation point. This allows engagement of cam to spline. Check circuit to verify contact at proper point. Repeat the cam adjustment steps as necessary. Lock manual cam on spline with set screw provided for additional security.
B. Operate actuator to opposite extreme (full Open), and adjust cams to suit.
C. Screw on cover and tighten against o-ring seal until cover does not turn.

See Pages 19-23 for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

MARK 3 DIRECT AND LEVER DRIVE INSTALLATION



INSTALLATION PROCEDURE

Mount the switch as necessary, concentric and perpendicular over the rotating shaft that is to be monitored. Direct drive yokes are available in many widths and lengths to fit your needs (Yokes are fabricated from spring temper stainless steel. Do not attempt to fabricate your own yokes.) Shaft drive units require an appropriate coupling (flexible type recommended) to the shaft being monitored.

ADJUSTING PROCEDURE

1. Remove cover by unscrewing. Take care to keep threads clean and free from damage.
2. Clockwise rotation of the yoke or shaft will move the bar up, counterclockwise moves it down. Switches are set at the factory for approximately one revolution of the yoke or shaft to actuate switch #1. Notice, that the cam screw for switch #1 is in location E. By changing that cam screw to location D, three additional revolutions of the yoke or shaft will be required to actuate #1 switch. Moving the cam screw to holes C, B or A will add three revolutions for each location moved, until 13 revolutions are required between switch #1 and 2 actuation.
3. The cam screw for switch #2 in location A. By moving it to location B, C, D, or E, three revolutions are added for each location change.
4. Rotate the switch slowly through the full cycle several times before tightening the bolts securely. Observe the rotation for signs of yoke or shaft misalignment or binding with the actuator shaft. Correct as necessary, then tighten the mounting bolts and recheck alignment.

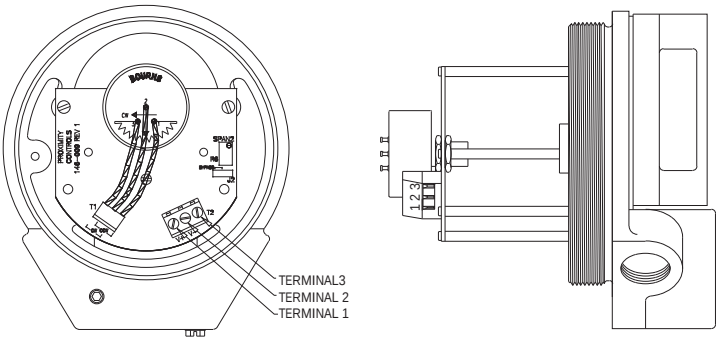
5. The following chart shows the various combinations of screw positions and resulting revolutions between switch actuation.

Cam Screw Locations		Number of Revolutions
Switch #1	Switch #2	Between Switch Actuation
E	A	1
D	D	4
C	A	7
B	A	10
A	A	13
A	B	16
A	C	19
A	D	22
A	E	25

6. Switch actuation at all intermediate number of revolutions or partial revolutions can be selected by turning the cam screws in or out when located at the nearest location shown above. Any partial number of turns may be selected, such as 4-1/2 or 12-3/4.

See Pages 19-23 for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

MARK 1, 3 AND 4 WITH POTENTIOMETER INSTALLATION



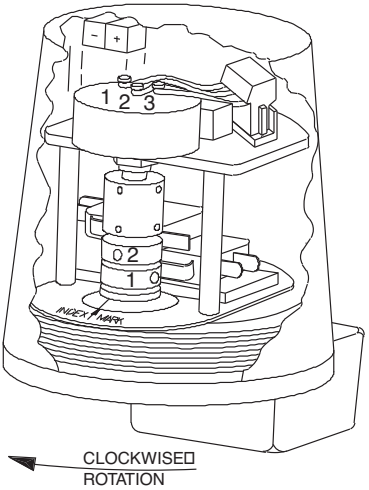
POTENTIOMETER RESISTANCE OHMS	OHMS PER DEGREE OF ROTATION	RESISTANCE BETWEEN PINS			
		NO. 2 to NO. 1		NO. 2 to NO. 3	
		CCW-SET	CW-90º	CCW-SET	CW-90º
1000	2.9	500	235	500	765
2000	5.8	1000	471	1000	1529
5000	14.7	2500	1178	2500	3823
10000	29.4	5000	2354	5000	7646
20000	58.8	10000	4708	10000	15294

INSTALLATION AND ADJUSTMENT

1. Attach the switch to the actuator or valve. Refer to Installation and Adjustment Instructions:
   - p. 9 for Direct Drive Mark 1 and 4 Models
   - p. 10-11 for Lever Drive Mark 1 and 4 Models
   - p. 12-13 for Mark 3 Models
2. Remove cover by unscrewing. Take care to keep threads clean and free from damage.
3. On models 13XXX and 43XXX, the switches are set at the factory when in the counterclockwise position as shown. Switch #1 is open, and #2 is closed. When cams are rotated 90º clockwise, #1 becomes closed and #2 is open. The cams may be adjusted to increase or decrease the 90º rotation. For model 33XXX refer to pages 12 and 13 for Switch Adjustment Procedure.
4. The potentiometer is positioned at the factory with the resistance element approximately centered. The resistance readings in the chart are typical of each different potentiometer.
5. To adjust the potentiometer to a different range, loosen the two lower set screws on the coupling. While holding the cams in the desired position, rotate the coupling and potentiometer shaft to the preferred location. Rotating clockwise reduces resistance between pins 2 and 1, and increases resistance between 2 and 3. Rotating counterclockwise increases resistance between pins 2 and 1, and reduces resistance between 2 and 3. If the resistance “jumps” rapidly, the pot is improperly rotated and functioning in the 20º dead area. Retighten the 2 set screws. A 2K span adjustment pot is provided, to activate move bypass shunt to the other pin.

See Pages 19-23 for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

MARK 1, 3 AND 4 WITH TRANSMITTER INSTALLATION



POTENTIOMETER RESISTANCE OHMS	OHMS PER DEGREE OF ROTATION	ROTATION RANGE			
		MARK 1 & 4		MARK 3	
		MIN	MAX	MIN	MAX
1000	2.9	50º	300º	1.5 turns	8.5 turns
2000	5.8	25º	150º	.75 turns	4.3 turns

Models 15XXX, 35XXX and 45XXX Rotary Position Indicating Switches contain a 4-20 mA Transmitter and two Single Pole Double Throw (SPDT) Micro switches. Models 150XX, 350XX and 450XX contain a 4-20 mA transmitter only, no switches.

- 4-20 mA output is fully adjustable for various rotations (zero and span). See chart above for rotation ranges using various potentiometers.
- 4-20 mA circuit is supply reversal protected and thermal protected.
- Clockwise or counterclockwise rotation corresponding to increased current output can conveniently field selected with plug connector.

INSTALLATION AND ADJUSTMENT

1. Attach the switch to the actuator or valve. Refer to Installation and Adjustment instructions:
   p. 9 for Direct Drive Mark 1 and 4 Models
   p. 10-11 for Lever Drive Mark 1 and 4 Models
   p. 12-13 for Mark 3 Models
2. Remove cover by unscrewing. Take care to keep threads clean and free from damage.
3. On models 15XXX and 45XXX, the switches are set at the factory when in the counterclockwise position as shown. Switch #1 is open, and #2 is closed. When cams are rotated 90º clockwise, #1 becomes closed and #2 is open. The cams may be adjusted to increase or decrease the 90º rotation. For model 35XXX refer to pages 12 and 13 for Switch Adjustment Procedure.

4. The potentiometer is positioned at the factory with the resistance element approximately centered.

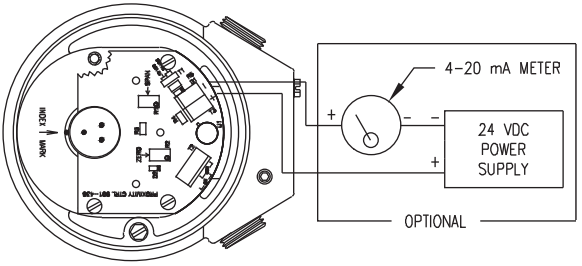
CALIBRATION

A. Set the valve at the position where you want the meter to read 0% (that is 4 mA). It may be necessary to move the plug connector to change the direction of current output to increasing for clockwise rotation or vice versa.
B. On models 15XXX, loosen the two bottom set screws on the coupling. Rotate the coupling and potentiometer shaft to the position where the meter reads 0% (4 mA). Tighten two set screws.
C. Turn valve to opposite position where meter should read 100% (20 mA). Use small screwdriver to adjust the blue rectangular potentiometer "span" until 100% (20 mA) is on the meter. If it is not possible to reach 100%, refer to Troubleshooting instructions.
D. Return valve to original position at 0% (4mA). Use small screwdriver to adjust "zero" turning until 0% (4 mA) is read on meter. Repeat steps C & D until 4 and 20 mA read consistently on each end of stroke.

TROUBLESHOOTING

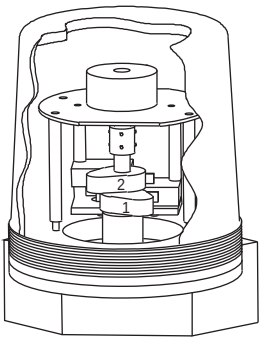
I. If no current flows, check polarity of current loop (plus and minus screws on terminal strip). Also check loop resistance for open line.
II. If full output current cannot be achieved by adjustment, voltage at transmitter may be too low. If so, increase power supply voltage until a minimum of 15 volts is registered or move voltage shunt to 12 VDC.
III. If current increases and decreases in the wrong direction, move the plug Connector from CW to CCW or vice versa.
IV. Check specs to make sure you are in range of adjustment, (See chart on previous page).
V. If the zero adjustment does not have enough range, the zero must be mechanically realigned as follows: Set the “zero” (fine 4 mA) adjustment to the middle of its range. (Full multi-turn range is 25 revolutions; set at 12-1/2 revolutions.) Repeat calibration steps B, C and D.

Two Wire Connections



See Pages 19-23 for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

MARK 1, 3 AND 4 TRANSMITTER WITH HART® COMMUNICATION INSTALLATION



Models 19XXX, 39XXX and 49XXX Rotary Position Indicating Switches contain a 4-20 mA Transmitter with HART® communication and two Single Pole Double Throw (SPDT) Micro switches. Models 190XX, 390XX and 490XX contain a 4-20 mA transmitter with HART® communication only, no switches.

- 4-20 mA output is fully adjustable for various rotations (zero and span) using pushbuttons or a HART® communication master.
- 4-20 mA circuit is polarity insensitive and thermal protected. Though the output terminals are labeled (+) and (-) the transmitter will function if the terminals are reversed.
- Clockwise or counterclockwise rotation corresponding to increased current output can be selected by use of zero and span pushbuttons or a HART® communication master.

INSTALLATION AND ADJUSTMENT

1. Attach the switch to the actuator or valve. Refer to Installation and Adjustment instructions:
   p. 9 for Direct Drive Mark 1 and 4 Models
   p. 10-11 for Lever Drive Mark 1 and 4 Models
   p. 12-13 for Mark 3 Models
2. Remove cover by unscrewing. Take care to keep threads clean and free from damage.
3. On models 19XXX and 49XXX, the switches are set at the factory when in the counterclockwise position as shown. Switch #1 is open, and #2 is closed. When cams are rotated 90º clockwise, #1 becomes closed and #2 is open. The cams may be adjusted to increase or decrease the 90º rotation. For model 39XXX refer to pages 12 and 13 for Switch Adjustment Procedure.
4. The potentiometer is positioned at the factory with the resistance element approximately centered.

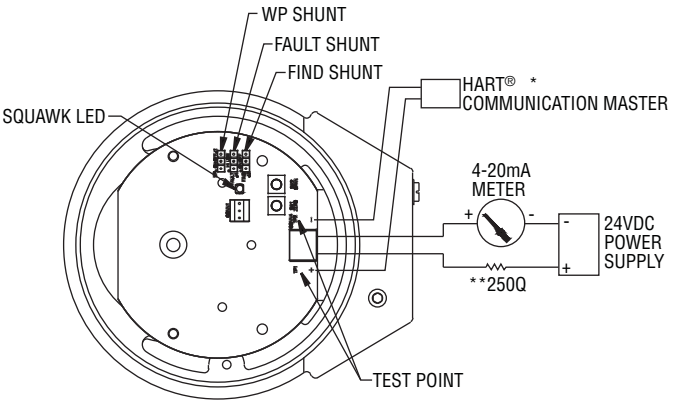
CIRCUIT BOARD FEATURES

- Two test points are provided as a convenience for attaching a HART® communication master.
- The WP (write project) shunt enables and disables the ability to change configuration settings. It can prevent unintended configuration changes from an accidental press of the ZERO or SPAN button and from communications with a HART® communication master. Set this shunt to ON to prevent configuration changes. Set this shunt to OFF to allow configuration changes.
- The FAULT shunt determines whether the transmitter fails high or low in a fault condition. When set to high the transmitter will output 21.0 mA in a fault condition. When set to low the transmitter will output 3.6 mA in a fault condition. The transmitter will output 3.8 mA and 20.5 mA when operating normally.
- The FIND shunt determines if the transmitter will respond to a FIND command. When set to ON the transmitter will respond to a HART® communication master's Find Command. When set to OFF the transmitter will ignore FIND commands. This is useful for allowing a HART® communication master to discover the transmitter.
- The LED will flash in response to a HART® communication master's Squawk Command. This is useful for identifying a transmitter attached to a HART® communication master.

CALIBRATION

A. Place the WP shunt in the OFF position if necessary to allow calibration to be performed.
B. Set the valve at the position where you want the meter to read 0% (that is 4 mA). Press and hold the ZERO pushbutton for two seconds or use a HART® communication master to set the ZERO point.
C. Turn valve to opposite position where meter should read 100% (20 mA). Press and hold the SPAN push button for two seconds or use a HART® communication master to set the SPAN point.
D. Reposition the WP shunt if desired.

* OPTIONAL, MAYBE CONNECTED TO TEST POINT AS SHOWN OR TO SCREW TERMINALS
** REQUIRED FOR HART® COMMUNICATIONS, OPTIONAL OTHERWISE



See Pages 19-23 for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

WIRING PROCEDURE: GENERAL
- Complete all electrical wiring in accordance with Local and National Electrical Codes by qualified personnel
- It may be necessary to segregate power and signal circuits in separate conduit entries.
- Secure ground wire/s under grounding (earthing) screw/s provided.
- Products with flying leads shall be terminated in approved junction box.

WIRING PROCEDURE: HAZARDOUS LOCATIONS, FLAMEPROOF
CABLE CONNECTION:
- The cable entry device shall be certified in type of explosion protection flameproof enclosure "d" suitable for the conditions of use and correctly installed.
- For ambient temperatures above 65°C, cables and cable glands suitable for at least 95°C shall be used.

CONDUIT CONNECTION:
- An Ex d, EEx d or UL and/or CSA (with appropriate classes and groups) certified sealing device such as a conduit seal with setting compound shall be provided immediately following the conduit entrance to the enclosure. UL & CSA listed factory sealed leads are provided from the factory on request.
- For ambient temperatures above 65°C, the wiring and setting compound in the conduit seal shall be suitable for at least 95°C.
- Degree of protection IP66/68W is maintained when suitable glands/plugs are used.

WIRING PROCEDURE: HAZARDOUS LOCATIONS, INTRINSIC SAFETY
- Potentiometer, Transmitter and each Switch and/or NAMUR Sensor must be treated as separate intrinsically safe circuits.

ELECTRICAL RATINGS:
- Potentiometer, see page number 4.
- Transmitter, see page number 4
- Switches, see model chart on page number 5.

INTRINSIC SAFETY INPUT PARAMETERS: (SUFFIX "IS")
- Potentiometer, Ui = 30V; Ii = 50mA; Pi = 0.65W.; Li = 0µH; Ci = 0nF.
- Transmitter, Ui = 30V; Ii = 100mA; Pi = 1.3W; Li = 0µH; Ci = 0nF.
- Switches, Ui = 30V; Ii = 100mA; Pi = 1.3W; Li = 0µH; Ci = 0nF.
- Namur Sensor, Ui = 16V; Ii = 76mA; Pi = 242mW; Li = 50µH; Ci = 40nF.
- Transmitter with HART® communication, Ui = 30V; Ii = 100mA; Pi = 1.3W; Li = 0µH; Ci = 4nF.

CAUTION: GENERAL
- Protection provided by the equipment may be impaired if the equipment is used in a manner not specified by the manufacturer.
- Risk of electric shock - disconnect supply circuit before opening. Keep unit tightly closed while circuits are alive.
- Suitable insulation between signal wiring and hazardous voltage wiring must be provided.

CAUTION: HAZARDOUS LOCATIONS, FLAMEPROOF
- Keep cover tightly closed when in operation.
- De-energize supply circuit before opening.
- To prevent ignition of hazardous locations, replace cover before energizing the electrical circuits.
- After de-energizing delay 3 minutes before opening.
- Do not open AS-interface equipped units when an explosive atmosphere may be present.

WARNING: MARK 4 FLAME PROOF ENCLOSURE OPTION B
- Repairs only to be conducted by Proximity Controls, A Division of Dwyer Instruments, Inc.
- Inspect thru shaft/bushing joint periodically for wear, if gap exceeds .0033″ (.084 mm) return to Proximity Controls, A Division of Dwyer Instruments, Inc. for repair or replace unit.

CAUTION: HAZARDOUS LOCATIONS, INTRINSIC SAFETY
- Enclosure must be protected from mechanical friction and impact with iron/steel to prevent ignition capable sparks.

ATTENTION: Units without suffix B or IS are not Directive 94/9/EC (ATEX) Compliant. These units are not intended or use in potentially hazardous atmospheres in the EU. These units may be CE marked for other Directives of the EU.

SCHEMATICS: GENERAL AND INTRINSIC SAFETY

1. Units supplied with switch option A, G, H, M or T have screw terminals on the back side of the switch for terminating wires.
2. Units supplied with switch option D are supplied with 36" minimum (0.91 meters) flying leads.
3. Units supplied with switch option B, C, I, R, S, V or W are supplied with terminal strips or 36˝ minimum (.091 meters) flying leads.
4. Units with J1 or J2 suffix are supplied with additional 2 or 4 termination points.

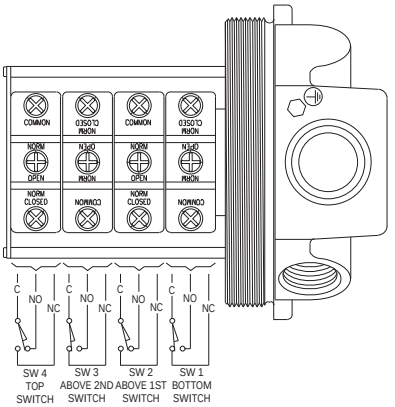


Figure 1: Wiring for switch types A, G, H, M, and T. 1, 2, or 4 switches.

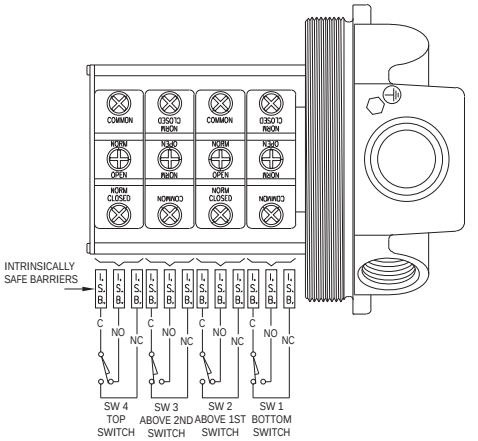


Figure 2: Intrinsically safe wiring for switch types A, G, H, M and T. 1, 2, or 4 switches

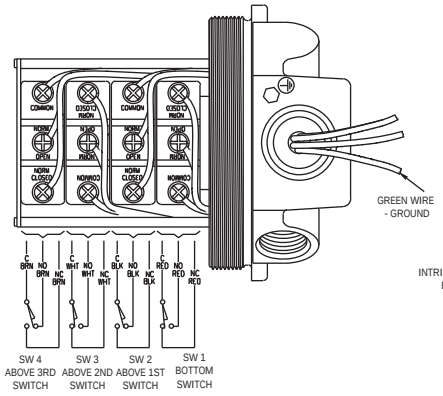

GREEN WIRE - GROUND
C BRN NO BRN NC BRN
C WHT NO WHT NC WHT
C BLK NO BLK NC BLK
C RED NO RED NC RED
SW 4 ABOVE 3RD SWITCH
SW 3 ABOVE 2ND SWITCH
SW 2 ABOVE 1ST SWITCH
SW 1 BOTTOM SWITCH

Figure 3: Wiring for factory sealed leads option. 1, 2, or 4 switches. Switch 1 wires are red, switch 2 wires are black, switch 3 wires are white, and switch 4 wires are brown. Wires are labeled C, NO, NC.

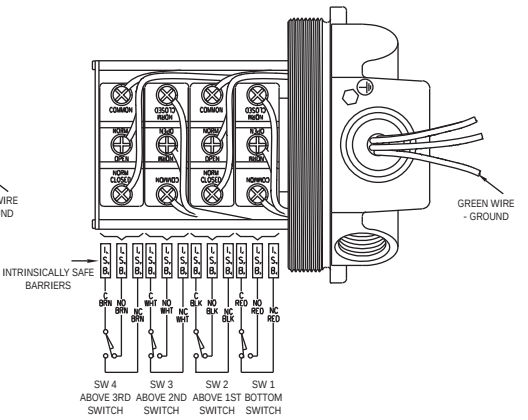

INTRINSICALLY SAFE BARRIERS
GREEN WIRE - GROUND
C BRN NO BRN NC BRN
C WHT NO WHT NC WHT
C BLK NO BLK NC BLK
C RED NO RED NC RED
SW 4 ABOVE 3RD SWITCH
SW 3 ABOVE 2ND SWITCH
SW 2 ABOVE 1ST SWITCH
SW 1 BOTTOM SWITCH

Figure 4: Intrinsically safe wiring for factory sealed leads option. 1, 2, or 4 switches. Switch 1 wires are red, switch 2 wires are black, switch 3 wires are white, and switch 4 wires are brown. Wires are labeled C, NO, NC.

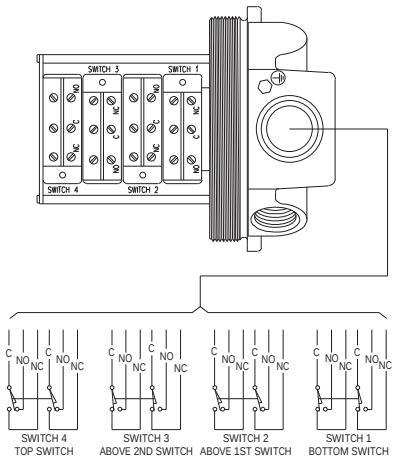


Figure 5: Wiring for switch type D. 1, 2, or 4 switches.

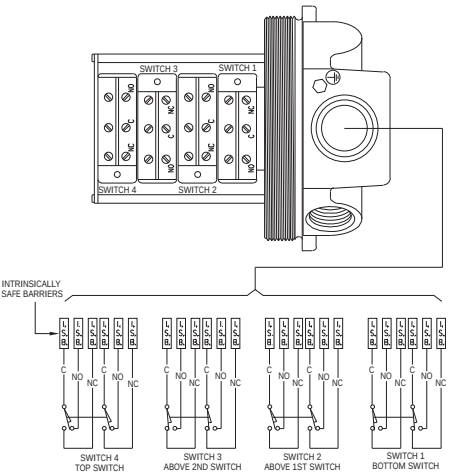


Figure 6: Intrinsically Safe wiring for switch type D. 1, 2, or 4 switches.

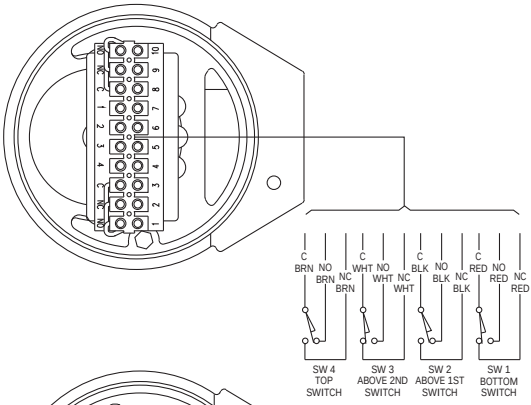


Figure 7: Wiring for switch types C, R, V and W. 1, 2, or 4 switches.

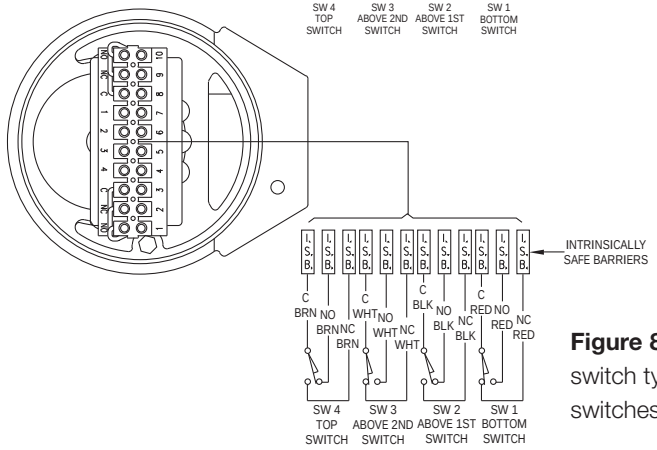


Figure 8: Intrinsically Safe wiring for switch types C, R, V, and W. 1, 2, or 4 switches

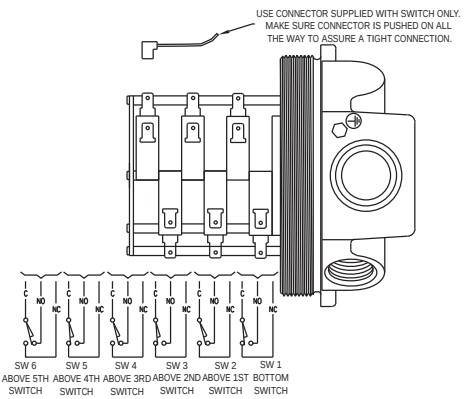

USE CONNECTOR SUPPLIED WITH SWITCH ONLY.
MAKE SURE CONNECTOR IS PUSHED ON ALL
THE WAY TO ASSURE A TIGHT CONNECTION.
C NO NC
SW 6 ABOVE 5TH SWITCH
SW 5 ABOVE 4TH SWITCH
SW 4 ABOVE 3RD SWITCH
SW 3 ABOVE 2ND SWITCH
SW 2 ABOVE 1ST SWITCH
SW 1 BOTTOM SWITCH

Figure 9: Wiring for switch types B, C, I, R, V, and W. 1, 2, 4, or 6 switches. Switch types B and I have "+" and "-" terminals.

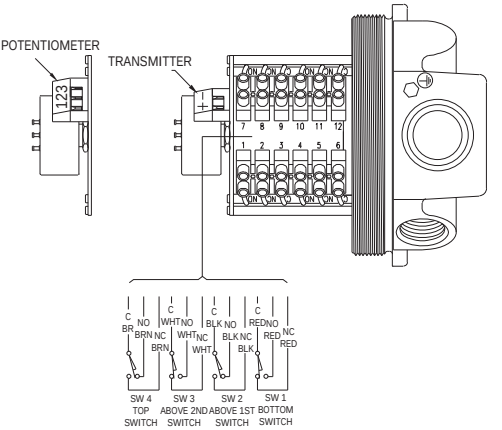


Figure 10: Wiring for potentiometer and transmitter outputs with switches. Refer to note at bottom of page 5 for switch details.

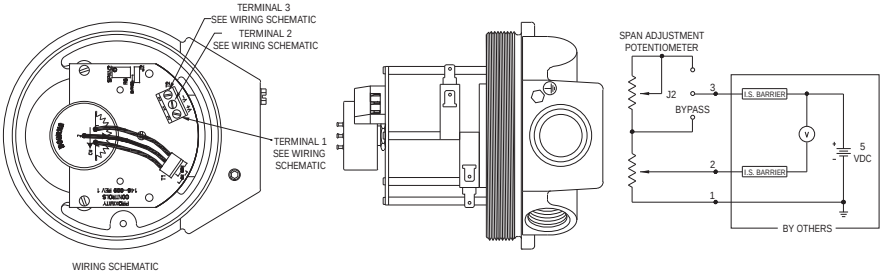


Figure 11: Intrinsically Safe wiring for potentiometer output. Refer to proper switch figure if unit has switches as well.

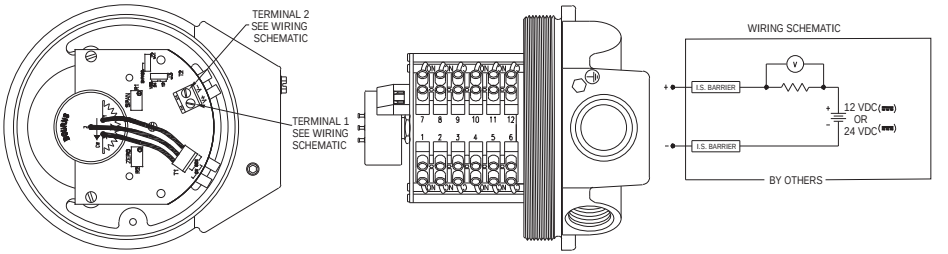


Figure 12: Intrinsically Safe wiring for transmitter output. Refer to proper switch figure if unit has switches as well.

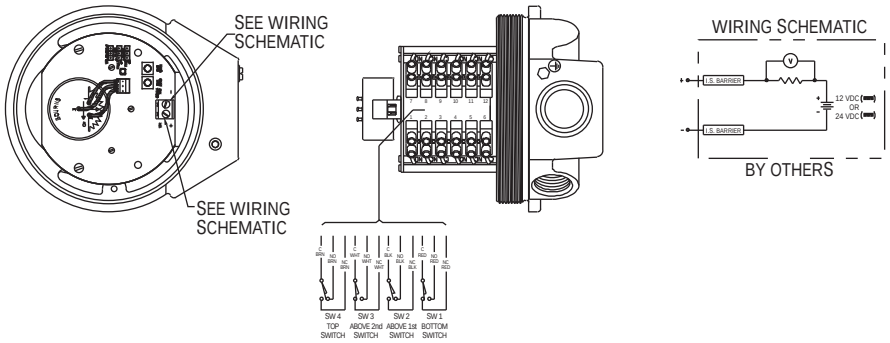


Figure 13: Intrinsically Safe Wiring for transmitter with HART® communication output. Refer to proper switch figure if unit has switches as well.

MAINTENANCE AND REPAIR

The moving parts of these units need no maintenance or lubrication. Some parts are replaceable by qualified personnel, contact the factory for details. WARNING: Substitution of components may impair intrinsic safety of models with IS suffix. Use a damp cloth with soap and water for cleaning and decontamination. Solvents may damage O-ring seals. Units in need of repair should be returned to the following address, freight prepaid. Be sure to include a brief explanation of the problem and any relevant application information.

Proximity Controls
Attn: Repair Department
1431 State Highway 210E
Fergus Falls, MN 56537

LIMITED WARRANTY

The Seller warrants all Dwyer Instruments, Inc. products and equipment to be free from defects in workmanship or material under normal use and service for a period of one year from date of shipment. Liability under this warranty is limited to repair or replacement F.O.B. factory of any parts which prove to be defective within that time or repayment of the purchase price at the Seller's option provided the instruments have been returned, transportation prepaid, within one year from date of purchase. All technical advice, recommendations, and services are based on technical data and information which the Seller believes to be reliable and are intended for use by persons having skill and knowledge of the business, at their own discretion. In no case is Seller liable beyond replacement of equipment F.O.B. factory for the full purchase price. This warranty does not apply if the maximum ratings label is removed or if the instrument or equipment is abused, altered, used at ratings above the maximum specified, or otherwise misused in any way.
This express limited warranty is in lieu of and excludes all other representations made by advertisements or by agents and all other warranties, both express and implied. There are no implied warranties of merchantability or fitness for a particular use for goods covered hereunder.

BUYER'S REMEDIES

The buyer's exclusive and sole remedy on account of or in respect to the furnishing of non-conforming or defective material shall be to secure replacement thereof as aforesaid. The Seller shall not in any event be liable for the cost of any labor expended on any such material or from any special, direct, indirect, consequential or incidental damages to anyone by reason of the fact that it shall have been non-conforming or defective.

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